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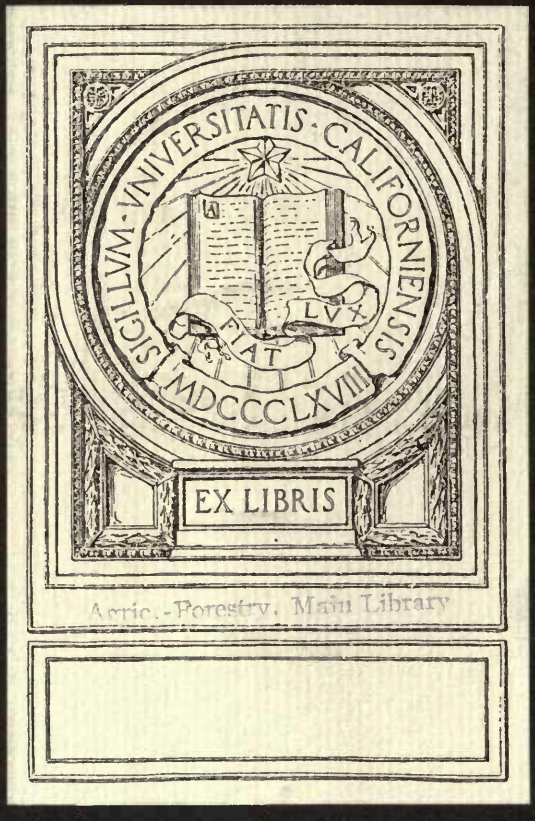

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Service.)

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

NOTES ON THE PROPOSED INTRODUCTION OF THE FRENCH SYSTEM OF TREATING POLES BY THE BOUCHERIX PROCESS FOR USE ON THE NATIONAL FORESTS

By

O. T. Swan

Forest Assistant, Forest Service

March, 1911.

APPLICABILITY OF THE BOUCHERIE SYSTEM OF POLE PRESERVATION TO THE NATIONAL FORESTS

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Introduction.

In 1910 the writer made a study of the methods and results of treating poles in several European countries. The Boucherie process in common use in France seemed applicable to certain conditions in the United States and especially to the National Forests. In June 1910, the subject was taken up with Assistant District Forester of District 5, Mr. C. Stowell Smith, who immediately saw the possibilities of the method and made plans to test it in California. Later the experiments were deferred until the summer of 1911.

The Boucherie process aims to fill the sapwood of susceptible species with a water solution of an antiseptic salt, generally copper sulphate. This is brought about by applying the solution under a gravity pressure of 20 to 30 feet to the butt of a freshly cut pole. The antiseptic solution is thus forced from end to end of the pole.

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General.

In France the telephone and telegraph lines are in charge of the federal department of Posts and Telegraphs. From 250,000 to 300,000 poles per year are consumed in the Government lines and practically all of these are treated with a solution of copper sulphate under what is known as the Boucherie process. Other preservatives are used to a comparatively small extent for experimental purposes.

Previous to 1874, creosote was used to a great extent for treating poles in France. Since that time the use of copper sulphate has become general for the treatment of poles. Creosote was objected to because the workmen found it very disagreeable and considerable trouble with them resulted. The men sometimes refused to handle the timber except at high wages. There was also trouble because creosote contaminated the water supply near places where treated timber was set.

The Boucherie process is not a revival of a dead process, but is is a method which has been in continuous and large use in Europe since it first became generally known. Today about one-third of the poles used in Germany and practically all of those used in France are treated under variations of this system. It can not be used in any climate or with any species of timber. For its

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successful operation a temperature above freezing is necessary and a species of timber largely sapwood. The system has the advantage of treating the entire pole at a very low cost. Further, only a relatively inexpensive equipment to do this work is required and after it is once in operation very little technical supervision is necessary. Copper sulphate is inexpensive and the amount necessary to treat a large number of poles can be very cheaply transported in the crystal form. For this reason the method seems well adapted to certain parts of the United States and especially some of the National Forests.

It will be necessary to make a number of experiments to find out just what success may be had in treating different American species since nothing has been attempted previously along this line.

Advantages and Disadvantages of the Use of Copper Sulphate.

A solution of copper sulphate is the solution commonly employed in this process. Among the disadvantages of the use of copper sulphate is the fact that it attacks iron, resulting in the formation of iron sulphate which destroys organic matter, but other metals which will not be attacked by the sulphate may be used in the equipment of the plant. The preservative action of copper sulphate is weakened by the presence of alkaline salts in the soil in which the poles are set. It is dissolved by rain water charged with carbonic acid. The water used in mixing the solution must be very pure.

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The Boucherie system has the advantage that inexpensive preservatives may be employed. Since they are used in solution the transportation of quantities sufficient for the treatment of a large number of poles is relatively cheap. The preservative for many poles is easily and cheaply stored. It is claimed that copper sulphate decreases the combustibility of the wood. The presence of the copper in treated wood is often apparent at sight, and is also proved by very easy and certain chemical tests. The equipment is relatively cheap, but a small amount of labor is required, and very little technical supervision is necessary.

Plant Required.

The plant necessary for treating poles by the Boucherie process consists of a tank of the copper sulphate solution raised on a tower or other support at a sufficient elevation to force the solution through the poles after a suitable apparatus communicating with the elevated tank has been connected at the butt of each pole. In order to supply the reservoir solution tank on the tower with additional quantities of the preservative, a mixing tank is set up at the foot of the tower. Here the proper proportions of pure water and copper sulphate are mixed, forming the treating solution. A hand pump or one run by an electric motor is generally installed to carry the solution

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A lead pipe runs from the elevated storage tank to a general supply pipe running the length of the skidways and from this the rubber tube is fitted with a hollow wooden pin which is either inserted into a solid block of wood, which acts as a stopper when no poles are being treated, or into the treating device clamped on the butt of each pole.

In order to force the fluid from one end of the pole to the other it is necessary to use an inexpensive device which may be fastened to the butt end of the pole. This part of the equipment consists of a solid wooden section a little larger than the butt end of the pole, generally made of one piece of oak or elm planking reinforced by a small strip of wood, the notched ends of which project on both sides of the wooden butt plate. The plate is held in position on the end of the pole by means of two iron pins, one of which is bent at right angles and sharpened in order that it may be driven firmly into the pole, while the other end which engages the notched strip of wood previously mentioned, is threaded and carries a washer and nut. In using this device, a circle of packing or a vulcanized rubber ring is placed between the wooden disc and

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the butt of the pole in such a manner as to form a chamber at least 1/2" deep between the end of the pole and the disc. The pins carrying the washer and nut are inserted in the notches of this butt equipment with their sharpened ends driven deep into the pole. The nuts are then screwed up very tightly, making the narrow chamber between the pole and disc practically water-tight. There is a small hole through the wooden plate and into this the hollow wooden piece at the end of the rubber tubing is inserted. This establishes the connection between the elevated storage tank and the fluid-tight chamber at the butt of the pole.

Process of Treatment.

The plant should be located on a level area and in case about 7,000 poles a year are to be treated, it is usual to have a space of about 55,000 square feet or an area 330 feet long by 165 feet wide. Such plants have a capacity of about 25 to 50 poles a day. The plants must, of course, be located near the place where the poles are cut.

For this reason the treatment of poles must be commenced within a very few days of the time of cutting, the length of time depending upon the season of the year. During the summer, treatments must begin within 3 or 4 days, while in the winter time they need not commence

for 8 or 10 days. The reason for this is that the poles must have seasoned as little as possible, retaining their normal quantity of sap and water. If any checks develop on the sides of the poles or through the bark the pole is in unsatisfactory shape for treatment, since the treating fluid may escape through these breaks. Further, if part of the sap has been lost through seasoning, it is found that the treatment is apt to be unsatisfactory through the pole. Therefore, the poles are hauled from the woods to the treating skidways as soon as possible after cutting, taking precautions not to injure the bark while transporting them since the bark is left on during the treatment.

The poles are placed on the treating skidways in a single even layer, the skids being so placed that there is a slight incline from the bottom of the pole toward the top. It is specified that the skids must be of sound, peeled timber, and must be removed as soon as they show signs of decay. A section of the butt of each pole is cut off in order to give a fresh and smooth surface for the connection of the apparatus to the pole. The butt of each pole is immediately fitted with the butt plate and connected with the large supply pipe running along the length of each skidway and described in the preceding pages.

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four days the copper sulphate begins to drip from the top end of the pole. In order to insure a thorough treatment this is allowed to continue for several days longer or until the solution lost at the top of the pole is of the same composition as that injected. The entire time for treating the poles may require a week or 10 days. No attempt is made to recover any of the copper sulphate which is lost in the drip from the top of the poles. In fact, the French specifications expressly prohibit its use in further operations. At the end of the week or ten days the top end of the pole is a very green copper sulphate color.

The solution which is used for this treatment consists of 1 kilogram of copper sulphate to 100 kilograms of water. This chemical must be crystalized and must not contain more than 1 per cent of foreign matter, while the strength in pure copper must not be less than 24-1/2 per cent. The height of the surface of the liquid in the elevated tank varies according to the maximum length of the pole which it is proposed to treat at the plant. The French practice is from 6 to 6-1/2 meters for poles 6-1/2 meters long, and 10 meters for poles up to 12 meters long, and about 12-1/2 meters for poles 15 meters long.

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within the pole. If the bark is removed immediately, the poles are apt to take on an undesirable dark or black color. At the end of the 30 days, the bark is removed from the poles and the top of each is pointed, cutting away from 6 to 12 inches of wood at that end. The freshly exposed surface at the top of the pole is then tested by the Government inspectors with a chemical reagent which gives a pink or reddish-brown color to the treated wood. (90 grams potassium ferrocyanide to 100 liters of water). From this color it is then possible to tell whether the treatment is satisfactory. Further, in order to be sure that the treatment is even and that the poles were not held too long before the treatment began, the Government inspectors have the right to cut up five poles per thousand and reject the entire lot if one of the five poles is below the requirements.

After the poles are accepted they are stamped with initials or marks indicating Government ownership and the name of the contractors who did the treating; also the date. The contractors must guarantee the poles for five years beginning with the first of January following the acceptance of the poles.

After the poles are accepted they are piled in high open piles for further seasoning, as shown in the photograph.

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Specifications.

The specifications governing poles treated by the Boucherie process for the French government include the following provisions:

Contracts for treated poles are made with the various companies supplying such material after competitive bids have been obtained.

In general only coniferous species of wood may be used, such as pine, fir, spruce, and larch, while the contract may specify only pine or fir. American white pine and Austrian pine, variety larico, are specifically excluded. Maritime pine which has been bled for turpentine may also be used, provided the exposed surface is not more than two feet long. No fire-killed trees can be used. Poles must be cut from healthy trees and the diameter of the heartwood at the top of the pole must not exceed two-thirds of the top diameter. The contract specifies the sizes and the percentage of each size required, giving the length of the pole, its circumference at 1 meter from the butt end and at the top.

The solution used in treating the poles shall consist of 1 kilogram of copper sulphate for each 100 liters of pure water. The salt must be in the crystallized state and must not contain more than 1 per cent of foreign matter. The strength of the crystallized copper sulphate in pure copper must not be less than 24.5 per cent.

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Provisions are included for a minimum height of the reservoir of the solution above the poles, which, of course, controls the pressure under which the solution is applied. In general, this height equals the length of the poles to be treated, except in the case of very long poles when the height of the reservoir is proportionally somewhat less. The solution must be injected from the butt end of the pole and must penetrate the entire pole in a uniform manner. The Government reserves the right to cut up any five poles selected from each thousand treated in order to see whether the penetration is satisfactory. If one pole out of the five selected is found to be improperly treated, the entire allotment may be rejected.

Thirty days after the poles are treated, but not sooner, they shall be peeled, shaved, and pointed at the top end. All refuse must be removed from the neighborhood of the skidways. The skidways must be of sound barked wood and must be replaced by the contractors at the first sign of decay.

For failure to comply with any of these provisions the contractor subjects himself to the possibility of the refusal of all poles which have been treated or which are being treated. The Government will pay for not exceeding 500 of the test poles which have been destroyed, irrespective of the total number of poles in the contractor's allotment. The remaining poles destroyed for inspection purposes shall be paid for by the contractor.

In case the treating yard is more than three kilometers from any habitable place, the contractor must provide transportation as often as 4 times per day, if required, to Government inspectors. Special provisions of a precautionary nature are also included in each contract according to the peculiar circumstances. The contractor shall be responsible for the perfect preservation of the treated poles for five years from the first day of January following the delivery of the material to the Government.

Cost.

A plant having a capacity of about 20,000 poles a year can be built in France for $1200. Copper sulphate is worth about 4-1/2 cents a pound in that country and it can probably be obtained cheaper in the United States if used in quantities. The cost of treating poles, including handling, runs from 30 to 80 cents for poles from 22 to 35 feet long.

Value of the Treatments.

Pine poles treated with copper sulphate last from six months to more than 25 years according to the character of the soil in which they are placed. But little is gained if the poles are in situations unfavorable to the treatment. Very wet locations, soils containing lime, and sandy soils are to be avoided.

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French officials state that they find the average life of their poles treated with this preservative at about 18 years in soil adapted to the treatment.

The average life secured in Germany, as shown elsewhere in this report, is 11.7 years. But this figure averages all conditions and grades of copper sulphate treatment. It is well understood that poles treated with zinc chloride should not be set in swamps but other and analogous conditions in the soil especially detrimental to copper sulphate have in many cases been disregarded.

The following statement shows the average life of poles in 30 representative lines in France under poor, medium, and good condition, and the character of the soil in which they were placed:

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Adaptability of the Process to American Conditions.

It is possible that experiments will demonstrate that under certain conditions the Boucherie process with copper sulphate or other preservatives may prove valuable in America. The National Forests appear to offer an exceptionally good field for trying out the process. The preservative, whether copper or other salts, can be transported long distances at a relatively small cost, an outfit can be devised that is not only very simple but easily moved from place to place, and the men in direct charge of the work are required to give a minimum amount of time to it, and to possess a minimum amount of technical knowledge to treat the poles. Poles can be skidded in lotsof 25 along the proposed line and treated immediately by a portable outfit consisting mainly of two or more barrels containing the solution slung from a tree by block and tackle and grab hooks, being raised high enough to secure the requisite pressure at the ground end of the treating tubes. After some experience approximately the right amount of solution for the skidway could be left in the barrels and no further attention given the treating until desired at a later visit.

The experiments should determine:

1. Adaptability of western conifers, abundant on the National Forests, to treatment by the Boucherie process for poles, posts, and other uses.

2. The various preservatives that may be adapted to the process.

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3. Means for ascertaining the extent of the treatment that a pole has received with each preservative.

4. The factors influencing the treatment of each species such as:

(a) Pressure of the solution at the point of application, or the height of reservoir tanks;

(b) Effect of excessive hot or cold weather;

(c) Effect of holding poles before treatment one to ten or more days after cutting;

(d) Practicability of water storage of poles between cutting and treatment.

5. Recovery and use of preservative ordinarily wasted in this process.

6. Specifications covering the treatment of American species by the Boucherie process.

7. Design of apparatus especially adapted to use on the forests.

8. The increased service resulting from treatments through a record of all poles set in lines.

Present Status of Experiments.

Arrangements are now being made by C. Stowell Smith, Assistant District Forester in Charge of Products in District 5, to determine the value of the process for certain pole timbers of the National Forests in that district. The experiments will be conducted on the Eldorado National Forest this summer.

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If the preliminary investigation warrants it, further experiments should be made on other Western forests, especially those of the Southwest and the central West where the use of creosote is practically prohibited by its high cost, and in the Southern States of the East where climatic conditions are favorable for the application of the treatment during the entire year and where the treatment of the entire pole is now necessary.